

**ESTIMATION OF GROWTH PARAMETERS OF THE VELVET SWIMMING CRAB (*LIOCARCINUS PUBER*) (BRACHYURA: PORTUNIDAE) AT PLYMOUTH, S.W. ENGLAND.**

*Liocarcinus puber* (L.) (formerly *Macropipus puber*) is a locally abundant portunid crab on rocky coasts of Western Europe. Recent overfishing in Spain and continued demand has allowed an export fishery to develop from the UK being centered in N.W. Scotland. Anecdotal information suggests that there may be significant variations in the growth format between Spain and N.W. Scotland, however management parameters for the UK fishery have been based largely on data from Spain.

Approximately 4,000 specimens were sampled by hand from the intertidal, and via SCUBA, nearshore sub-littoral areas, from November 1985 to December 1987. Size frequency analysis from monthly samples readily described the growth of juveniles, attaining a mean model size of 40–45 mm Carapace Width at an age of 1 y. Sexual maturity occurs at  $c. 1 y$  ( $= 46.5$ ,  $= 40.6$  estimated from allometric growth of chela and abdomen) (Norman, 1989). Adult modes showed no clear definition into year classes.

Examination of moult stages of adults from monthly samples showed a marked peak in early post-moult crabs (soft and paper-shell stages) in June/July for males and in August for females and a smaller peak in autumn. Laboratory rearing under simulated natural conditions, showed similar moult periodicity, with large adults ( $>60$  mm,  $>50$  mm CW) moulting annually, males in June and females in July/August, whilst smaller adults moulted at corresponding times in

larger adults and again between September and December. Male growth curve showed close agreement with other methods, whilst females showed reduced growth from  $>55$  mm CW (Fig. 1); this probably being due to increased reproductive effort.

ELEFAN (Pauly, 1987), a programme which fits a continuous growth curve to monthly size frequency data via a least squares optimisation process showed clear optimisation of parameters, but low agreement between actual and estimated parameters due to the discontinuous nature of crustacean growth as well as the natural variation within the sample. The probability paper technique (Cassie, 1954) due to the difficulty in distinguishing moult classes from year classes and requirement of subjective assessment, was felt to be less robust than other methods. Estimates for the growth constant (K) between the three methods ranged from, for male 0.28 to 0.34, and female 0.35 to 0.45, and for the asymptotic length ( $L_{\infty}$ ), for male 107 to 114, and female 91 to 98.

Size frequently analysis from Spain (González Gurriarán, 1985) gave higher estimates of K (0.65, 0.67), but comparative  $L_{\infty}$  ( $= 109$ ,  $= 96$ ). In both studies age of sexual maturity is approx. 1 year, but at correspondingly different sizes (Fig. 1). The validity of this difference in size of sexual maturity is further endorsed by measurements from allometric growth, the size of smallest ovigerous female and size at which 50% of sample have mature ovaries, for each, estimates from Spain are consistently larger, by approx. 10 mm, than for Plymouth (González Gurriarán, 1985; Norman, 1989).

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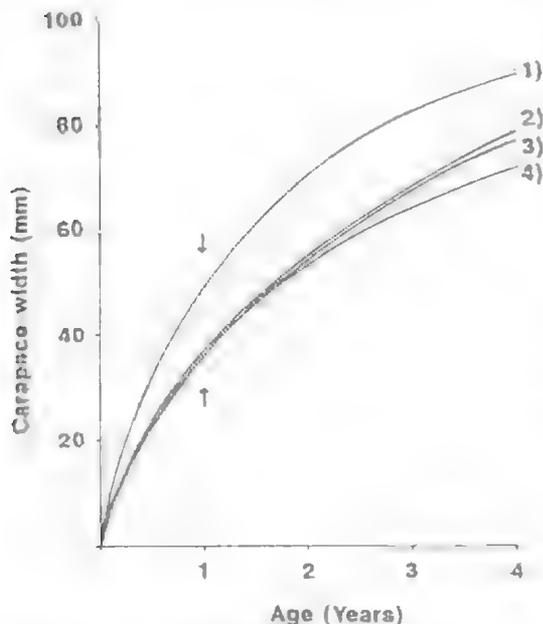


FIG. 1. Von Bertalanffy growth curves for female *Liocarcinus puber* from 1) Spain (González Gurriarán, 1985) and 2), 3) and 4) this study, ELEFAN, probability paper technique and laboratory rearing respectively. Arrows demark size at 1 year old.